Meeting of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction

25 July 2018

English only

2018 Meeting
Geneva, 4-7 December 2018

Meeting of Experts on Review of developments in the field of science and technology related to the Convention
Geneva, 9-10 August 2018
Items 4 to 8 of the provisional agenda

Review of science and technology developments relevant to the Convention, including for the enhanced implementation of all articles of the Convention as well as the identification of potential benefits and risks of new science and technology developments relevant to the Convention, with a particular attention to positive implications

Biological risk assessment and management

Development of a voluntary model code of conduct for biological scie tists and all relevant personnel, and biosecurity education, by drawing on the work already done on this issue in the context of the Convention, adaptable to national requirements

Genome editing, taking into consideration, as appropriate, the issues identified above

Any other science and technology developments of relevance to the Convention and also to the activities of relevant multilateral organizations such as the World Health Organization (WHO), World Organisation for Animal Health (OIE), Food and Agriculture Organization (FAO), Intergovernmental Panel on Climate Change (IPPC) and Organisation for the Prohibition of Chemical Weapons (OPCW)

Background information

Submitted by Implementation Support Unit (ISU)

I. Introduction

1. The 2017 Meeting of States Parties to the Biological Weapons Convention reached consensus on an intersessional programme from 2018 to 2020. The purpose of the intersessional programme is to discuss, and promote common understanding and effective action on those issues identified for inclusion in the intersessional programme. The work in the intersessional period will be guided by the aim of strengthening the implementation of all articles of the Convention in order to better respond to current challenges.[1]

[1] See BWC/MSP/2017/6, paragraph 19.

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2. The intersessional programme consists of annual Meetings of States Parties preceded by annual Meetings of Experts. Each Meeting of Experts will prepare for the consideration of the annual Meeting of States Parties a factual report reflecting its deliberations, including possible outcomes. All meetings, both of Experts and of States Parties will reach any conclusions or results by consensus. The Ninth Review Conference will consider the work and outcomes it receives from the Meetings of States Parties and the Meetings of Experts and decide by consensus on any inputs from the intersessional programme and on any further action.

3. Out of the eight days allocated per year for the five open-ended Meetings of Experts, two days will be allocated to the topic of "Review of developments in the field of science and technology related to the Convention" to be discussed by the second Meeting of Experts (MX2). States Parties decided that MX2 will consider the following topics:

(a) Review of science and technology developments relevant to the Convention, including for the enhanced implementation of all articles of the Convention as well as the identification of potential benefits and risks of new science and technology developments relevant to the Convention, with a particular attention to positive implications;

(b) Biological risk assessment and management;

(c) Development of a voluntary model code of conduct for biological scientists and all relevant personnel, and biosecurity education, by drawing on the work already done on this issue in the context of the Convention, adaptable to national requirements;

(d) In 2018, genome editing, taking into consideration, as appropriate, the issues identified above; and

(e) Any other science and technology developments of relevance to the Convention and also to the activities of relevant multilateral organizations such as the WHO, OIE, FAO, IPPC and OPCW.

4. The purpose of this paper is to facilitate States Parties' preparations for and deliberations during MX2 by providing relevant background information on the above five topics. This document therefore describes relevant provisions in the Convention and discussions on these topics during previous intersessional programmes. Finally, the present paper also provides information on any mandated activities given to the Implementation Support Unit (ISU) on the subject matter.

5. This document has three Annexes containing information relating to the topics to be discussed by MX2: Annex I contains the full text of the additional understandings and agreements reached by successive review conferences; Annex II contains the full text of the common understandings reached by States Parties during the previous intersessional programme from 2012 to 2015; and Annex III lists working papers presented by States Parties between 2012 and 2017 on the topics to be considered by MX2.

II. Convention provisions and additional understandings and agreements reached by previous review conferences

6. Science and technology is not addressed by one specific article of the Convention and the words "science" or "scientific" only appear three times in the Convention. Science and technology has been considered in particular in the context of Article I which addresses the scope of the Convention. Article I reads as follows:

> "Each State Party to this Convention undertakes never in any circumstances to develop, produce, stockpile or otherwise acquire or retain:

(1) Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;

(2) Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict."

Additional understandings and agreements reached by previous review conferences regarding Article I are provided in Annex I.

7. In addition, paragraph 1 of Article X states that:

"(1) The States Parties to this Convention undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the use of bacteriological (biological) agents and toxins for peaceful purposes. Parties to the Convention in a position to do so shall also cooperate in contributing individually or together with other States or international organizations to the further development and application of scientific discoveries in the field of bacteriology (biology) for prevention of disease, or for other peaceful purposes."

8. Additional understandings and agreements reached by previous review conferences on Article X have already been provided in Annex I to document BWC/MSP/2018/MX.1/2 and are therefore not repeated again here.

9. Finally, Article XII refers to the fact that the review conference should "take account of relevant developments in the field of science and technology". Additional understandings and agreements reached by previous review conferences regarding Article XII are provided in Annex I.

10. In addition, science and technology underpins several articles of the Convention and has also been addressed in specific contexts, for example the Ad Hoc Meeting of Scientific and Technical Experts from States Parties to Finalise the Modalities for the Exchange of Information and Data which met in 1987 to develop the forms for the Confidence-Building Measures, or the Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical standpoint (VEREX), which met from 1992 to 1993. Information on these is provided in document BWC/MSP/2018/MX.5/2.

III. Common understandings reached by States Parties during previous intersessional programmes

11. During the last intersessional programme from 2012 to 2015, States Parties considered the topic of 'Review of developments in the field of science and technology related to the Convention' as a standing agenda item at both the Meetings of Experts and the Meetings of States Parties in every year from 2012 to 2015. Under this standing agenda item, the States Parties addressed the following topics:

(a) new science and technology developments that have potential for uses contrary to the provisions of the Convention;

(b) new science and technology developments that have potential benefits for the Convention, including those of special relevance to disease surveillance, diagnosis and mitigation;

(c) possible measures for strengthening national biological risk management, as appropriate, in research and development involving new science and technology developments of relevance to the Convention;

(d) voluntary codes of conduct and other measures to encourage responsible conduct by scientists, academia and industry;

(e) education and awareness-raising about risks and benefits of life sciences and biotechnology.

(f) science- and technology-related developments relevant to the activities of multilateral organizations such as the WHO, OIE, FAO, IPPC and OPCW; and

(g) any other science and technology developments of relevance to the Convention.

12. In addition, the following topical scientific subjects were considered in the years indicated:

(a) advances in enabling technologies, including high-throughput systems for sequencing, synthesizing and analyzing DNA; bioinformatics and computational tools; and systems biology (considered in 2012);

(b) advances in technologies for surveillance, detection, diagnosis and mitigation of infectious diseases, and similar occurrences caused by toxins in humans, animals and plants (considered in 2013);

(c) advances in the understanding of pathogenicity, virulence, toxicology, immunology and related issues (considered in 2014); and

(d) advances in production, dispersal and delivery technologies of biological agents and toxins (considered in 2015).

13. At the Meetings of States Parties in 2012, 2013, 2014 and 2015, the States Parties reached various common understandings on these topics, which can be found in Annex II.

14. Prior to that, during the intersessional programme from 2007 to 2010, States Parties considered the topics of 'National, regional and international measures to improve biosafety and biosecurity, including laboratory safety and security of pathogens and toxins' and 'Oversight, education, awareness raising and adoption and/or development of codes of conduct with the aim of preventing misuse in the context of advances in bio-science and bio-technology research with the potential of use for purposes prohibited by the Convention'. These two topics were the subject of discussions at the Meeting of Experts and Meeting of States Parties in 2008. The common understandings reached on these topics by States Parties in 2008 can be found in document BWC/MSP/2008/5.

15. During the first intersessional programme from 2003 to 2005, States Parties considered the topics of 'National mechanisms to establish and maintain the security and oversight of pathogenic microorganisms and toxins' and 'The content, promulgation, and adoption of codes of conduct for scientists'. These two topics were the subject of discussions at the Meetings of Experts and the Meetings of States Parties in 2003 and 2005 respectively. The common understandings reached on these topics by States Parties in 2003 and 2005 can be found in documents BWC/MSP/2003/4 and BWC/MSP/2005/3 respectively.

IV. Relevant Activities of the Implementation Support Unit

16. Taking into account the importance of providing administrative support to meetings agreed by the Review Conference as well as comprehensive implementation and universalization of the Convention and the exchange of confidence-building measures, the Sixth Review Conference decided to establish the Implementation Support Unit (ISU). Among the tasks mandated to the ISU by the Review Conference was facilitating, upon request, States Parties' contacts with scientific and academic institutions, as well as non-governmental organizations. Since its formal establishment in 2007, the ISU has undertaken

to facilitate such contacts at the national, regional and international level. For example, the ISU has remained in contact with the InterAcademy Partnership, which represents academies of science from around the world.

17. In support of the three intersessional programmes from 2003 to 2005, 2007 to 2010 and 2012 to 2015, the ISU has also produced a large number of background information documents relating to science and technology. In order to support the intersessional programmes through the production of such documents, the ISU has attended many meetings, workshops and seminars relating to science and technology, as described in its annual reports to States Parties.

18. Under EU Council Decision 2016/51/CFSP which is being implemented by the United Nations Office for Disarmament Affairs and overseen by the ISU, a series of five regional workshops on the implications of developments in science and technology for the Convention are being conducted. The first such workshop took place in September 2017 in Kyiv, Ukraine for States Parties from Eastern Europe and Central Asia. This was followed by a workshop in Mexico City, Mexico for States Parties in Latin America and the Caribbean. At the time of writing, two more workshops were in the final planning stages – in Amman, Jordan for States Parties from the Middle East and North Africa and in Pretoria, South Africa for States Parties from Sub-Saharan Africa – both of which will take place in July. The final regional workshop, for States Parties in Asia, will take place later in 2018 in the Philippines.

19. Among the objectives for these workshops are the following: Increased awareness of the Convention among stakeholder communities; Increased involvement of the scientific community and national and regional scientific, professional and industrial associations in the implementation of the Convention; Deepening the understanding of scientific and technological issues to the implementation of the Convention among national policymakers and officials; Increased interaction between stakeholder communities, regulatory agencies and policymakers at national and regional levels and their enhanced input into reviews of scientific and technological developments relevant to the Convention; and Promotion of linkages with other multilateral and regional initiatives in the area of science and technology.

20. Each of these workshops considers topics from the intersessional programmes, and also topics chosen in consultation with the host country and scientific experts from within the region. Topics discussed at the two workshops conducted to date in Ukraine and Mexico have included the following: Scientific and technological developments of general concern in the life sciences relevant to the BWC; BWC relevant scientific and technological developments in the respective regions; Regulatory frameworks to prevent the misuse of science and technology; Life sciences, biotechnology and biosafety and security: Education and awareness-raising; Regional cooperation and capacity-building relating to science and technology for peaceful purposes.

V. Conclusions

21. Science and technology has been a long-standing topic for discussion among States Parties to the Convention. In 2011, it was selected by the Seventh Review Conference to be one of the three standing agenda items for the intersessional programme from 2012 to 2015, and in 2017 the Meeting of States Parties reached consensus on the establishment of five Meetings of Experts, including MX2 on science and technology.

22. Science and technology is also an area in which various scientific and academic institutions from around the world are very active, and the ISU has endeavoured to facilitate contacts with such organizations in accordance with its mandate and in support of the intersessional programmes agreed by States Parties.

Annex I

Additional understandings and agreements reached by previous Review Conferences

Article I

A. Convention text

"Each State Party to this Convention undertakes never in any circumstances to develop, produce, stockpile or otherwise acquire or retain:

(1) Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;

(2) Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict."

B. Additional understandings and agreements

On the scope of the article

6. The Third and Fourth Review Conferences reaffirmed "that the Convention prohibits the development, production, stockpiling, other acquisition or retention of microbial or other biological agents or toxins harmful to plants and animals, as well as humans, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes." [IV.I.2, III.I.2].

7. The Second[1], Third and Fourth Review Conferences reaffirmed that "the Convention unequivocally covers all microbial or other biological agents or toxins, naturally or artificially created or altered, as well as their components, whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes. The Second Review Conference added, consequently, toxins (both proteinaceous and non-proteinaceous) of a microbial, animal or vegetable nature and their synthetically produced analogues are covered. "[IV.I.5, III.I.3, II.I.5].

8. The Sixth, Seventh and Eighth Review Conferences reaffirmed "that the Convention is comprehensive in its scope and that all naturally or artificially created or altered microbial and other biological agents and toxins, as well as their components, regardless of their origin and method of production and whether they affect humans, animals or plants, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes, are unequivocally covered by Article I." [VIII.I.1, VII.I.1, VI.I.1].

On the use of biological agents and toxins

9. The Fourth, Sixth, Seventh and Eighth Review Conferences reaffirmed "that the use by States Parties, in any way and under any circumstances, of microbial or other biological

[1] Slightly different wording.

agents or toxins, that is not consistent with prophylactic, protective or other peaceful purposes, is effectively a violation of Article I." [VIII.I.3, VII.I.3, VI.I.3, IV.I.3].

10. The Sixth, Seventh and Eighth Review Conferences reaffirmed "the determination of States Parties to condemn any use of biological agents or toxins for other than peaceful purposes, by anyone at any time." [VIII.I.3, VII.I.3, VI.I.3].

11. The Sixth, Seventh and Eighth Review Conferences reaffirmed "the undertaking in Article I never in any circumstances to develop, produce, stockpile or otherwise acquire or retain weapons, equipment, or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict in order to exclude completely and forever the possibility of their use." [VIII.I.3, VII.I.3, VI.I.3].

12. The Third, Fourth, Sixth, Seventh and Eighth Review Conferences noted that "experimentation involving open-air release of pathogens or toxins harmful to humans, animals and plants that have no justification for prophylactic, protective or other peaceful purposes is inconsistent with the undertakings contained in Article I." [VIII.I.4, VII.I.4, VI.I.4, IV.I.7, III.I.4].

13. The Third Review Conference stressed that "States parties should take all necessary safety precautions to protect populations and the environment in relation to activities not prohibited by the Convention." [III.I.5].

On scientific and technological developments

14. The Second Review Conference concluded "that the scope of Article I covers scientific and technological developments relevant to the Convention." [II.I.2].

15. The Second, Third and Fourth Review Conferences, "conscious of apprehensions arising from relevant scientific and technological developments, inter alia, in the fields of microbiology, genetic engineering and biotechnology, and the possibilities of their use for purposes inconsistent with the objectives and the provisions of the Convention, reaffirmed that the undertaking given by the States Parties in Article I applies to all such developments. The Fourth Review Conference supplemented the list of scientific and technological developments with molecular biology… and any applications resulting from genome studies." [IV.I.6, III.I.3, II.I.4].

16. The Sixth, Seventh and Eighth Review Conferences reaffirmed "that Article I applies to all scientific and technological developments in the life sciences and in other fields of science relevant to the Convention." [VIII.I.2, VII.I.2, VI.I.2].

17. The Third[2] and Fourth Review Conferences appealed "through the States Parties to their scientific communities to lend their support only to activities that have justification for prophylactic, protective and other peaceful purposes, and refrain from undertaking or supporting activities which are in breach of the obligations deriving from provisions of the Convention." [IV.I.8, III.I.7].

[2] Slightly different wording

Article XII

A. Convention text

"Five years after the entry into force of this Convention, or earlier if it is requested by a majority of Parties to the Convention by submitting a proposal to this effect to the Depositary Governments, a conference of States Parties to the Convention shall be held at Geneva, Switzerland, to review the operation of the Convention, with a view to assuring that the purposes of the preamble and the provisions of the Convention, including the provisions concerning negotiations on chemical weapons, are being realized. Such review shall take into account any new scientific and technological developments relevant to the Convention."

B. Additional understandings and agreements

On the review conference process

137. The First[3], Sixth, Seventh and Eighth Review Conferences reaffirmed that Review Conferences "constitute an effective method of reviewing the operation of the Convention with a view to ensuring that the purposes of the Preamble and provisions of the Convention are being realized." [VIII.XII.76, VII.XII.65, VI.XII.60, I.XII.1]. The First Review Conference added "in particular with respect to any new scientific and technological developments relevant to the Convention." [I.XII.1].

138. The Third[4], Fourth and Sixth Review Conferences recommended that "Review Conferences should continue to be held at least every five years." [VI.XII.60, IV.XII.3, III.XII.3].

139. The Seventh and the Eighth Review Conferences decided "that Review Conferences be held at least every five years." [VII.XII.65].

On scientific and technological developments

140. The First Review Conference decided that "any information provided by States Parties on scientific and technological developments relevant to the Convention, and on its implementation, shall be made available periodically to States Parties, in particular through the United Nations Centre for Disarmament" [now the United Nations Office for Disarmament Affairs]. [I.XII.3].

[3] Slightly different wording
[4] Slightly different wording

Annex II

Common Understandings reached by the Meetings of States Parties during the Intersessional Programme held from 2012 to 2015 relating to review of developments in the field of science and technology related to the Convention

A. 2012

44. States Parties reviewed various enabling technologies, including, for example, in: bioinformatics; computational biology; DNA microarrays; gene synthesis technology; high through put mass spectrometry; high-throughput sequencing; nanotechnology; synthetic biology; systems biology; and whole-genome directed evolution. States Parties agreed that these developments could provide for faster, cheaper, and easier application of biological science and technology. These enabling technologies can affect how science is conducted and applied. This will bring both benefits and challenges for the Convention which may require action by States Parties.

45. States Parties agreed that certain developments in science and technology have potential benefits for the Convention, including: improved identification of agents for both public health and security purposes; increasing capacity to investigate the possible use of biological weapons; improved understanding of the nature of disease; and better healthcare technologies such as improved, more efficient and economical vaccines, antibiotics, and their means of delivery, as well as point-of-care diagnostic systems.

46. States Parties also agreed that certain developments in science and technology have the potential for use contrary to the provisions of the Convention now or in the future. These developments include, inter alia, increased capacity to manipulate the pathogenicity, host-specificity, transmissibility, resistance to drugs, or ability to overcome host immunity to pathogens; to synthesize pathogens and toxins without cultivation of microorganisms or using other natural sources; to identify new mechanisms to disrupt the healthy functioning of humans, animals and plants; and to develop novel means of delivering biological agents and toxins. States Parties also agreed on the importance of facilitating the fullest possible exchange of dual-use technologies where their use is fully consistent with the peaceful object and purpose of the Convention.

47. States Parties identified opportunities for maximising benefits from these enabling technologies while minimizing risks of their application for prohibited purposes, including, for example, supporting:

(a) Efforts to ensure the fullest possible exchange of equipment, materials and scientific and technological information and in full conformity with the provisions of the Convention;

(b) Enhanced national oversight of dual use research of concern without hampering the fullest possible exchange of knowledge and technology for peaceful purposes;

(c) Continued discussion under the Convention on oversight of dual use research of concern;

(d) Improved use by relevant national agencies of available sequence and function data;

(e) Enhanced reference databases to support identification of agents by relevant national agencies; and

(f) Promotion of the beneficial applications of gene synthesis technologies while ensuring their use is fully consistent with the peaceful object and purpose of the Convention.

48. States Parties noted these enabling technologies were the result of a convergence of different sciences and technologies. States Parties recognized the relevance to the Convention of an increasing convergence of scientific disciplines, in particular biology and chemistry. This convergence increases the importance of building and sustaining coordination between the Convention and the Chemical Weapons Convention while respecting the legal and institutional bases of each convention.

49. States Parties reiterated the importance of measures, in accordance with national laws and regulations, to increase awareness among scientists, academia and industry of the Convention and related laws and regulations. States Parties noted the value, on a voluntary basis of using of codes of conduct including those based on the principles of autonomy, beneficence and integrity, in accordance with national laws and regulations. In this regard, States Parties can provide international leadership, facilitate coordination and promote communication. States Parties recognized the value of pursuing various national measures, in accordance with national needs and circumstances, such as:

(a) Promoting interaction between relevant national agencies and the scientific community;

(b) Strengthening linkages between biosafety and biosecurity training and broader issues of responsible conduct;

(c) Encouraging the addition of relevant elements to existing codes, where they exist, as an alternative to developing new codes;

(d) Supporting the inclusion of relevant material in professional training courses;

(e) Encouraging the development of practical tools for use by individuals and organizations to familiarize them with the provisions of the Convention; as well as

(f) Enabling specific outreach for those working outside of institutional research and commercial environments.

50. States Parties recognized the valuable contribution to their work of associated stakeholders in science, academia and industry agreed on the importance of continuing to encourage them to participate, as appropriate, in the intersessional programme.

B. 2013

51. States Parties identified certain developments in science and technology that have potential benefits for the Convention and agreed on the need to share information on these developments, including:

(a) Improving identification of biological agents and toxins for both health and security purposes, resulting from advances in life science research, including metagenomics, immunological methods, molecular probes, amplification of nucleic acids, and in microbial forensics;

(b) Advances in comparative genomics, which would increase the capacity to investigate alleged use of biological weapons;

(c) Improved, more efficient and economical vaccine and diagnostic technologies, resulting from advances in:

i. Identifying new targets and reducing the timescale for the development of vaccines, drugs and diagnostics;

ii. Production of vaccines including through developments in single-use or disposable bioreactor systems, which can increase yield, cost-effectiveness, portability and safety, and novel vaccine production methods, including cell cultures and cell suspension bioreactors, recombinant DNA, metabolic engineering and synthetic biology, chemical peptide synthesis; and transgenic animals and plants;

iii. Vaccine distribution and delivery, such as encapsulation in silk matrices, nano-vesicles, and nanotechnology-based patches;

iv. Point-of-care diagnostic systems suitable for use in low resource settings resulting from advances in microfluidics, nanotechnology, lateral flow immunoassays and new techniques emerging from multidisciplinary collaborations that combine different approaches into simple devices;

(d) Enhanced epidemiological capacity including for identifying unknown pathogens, outbreak sources and animal reservoirs, resulting from advances in faster and less expensive high-throughput DNA sequencing, along with parallel advances in computational biology.

52. States Parties agreed that some of the developments reviewed have the potential for uses contrary to the provisions of the Convention, including manipulating the pathogenicity, host-specificity, transmissibility, resistance to drugs, or ability to overcome host immunity to pathogens, and increasing the production efficiency and the effectiveness of biological weapons agents. States Parties also agreed on the importance of facilitating the fullest possible exchange of dual-use technologies where their use is fully consistent with the peaceful object and purpose of the Convention.

53. In order to further seize opportunities for maximizing benefits from advances in science and technology while minimizing the risk of their application for prohibited purposes, States Parties noted the value of:

(a) Promoting access to, and use of, the technologies they reviewed, including through the development of inexpensive and field-portable applications;

(b) Promoting appropriate oversight measures to identify and manage such risks, ensuring that they are proportional to the assessed risk, take into account both risks and benefits, and avoid hampering legitimate peaceful activities;

(c) Recognizing that a one-size-fits-all approach is unsuitable, exploring approaches for developing guiding principles that could be tailored to national circumstances;

(d) Undertaking efforts to engage the scientific community, research funding organizations and, when appropriate, industry in dialogue about how best to identify and manage these risks;

(e) Sharing information about oversight frameworks, guiding principles, and practical experience with other States Parties.

(f) Continuing discussion under the Convention on dual use research, bringing in a wide range of national and international stakeholders and focusing on specific instances in order to better understand options for mitigating risks;

(g) The elaboration of models to inform risk assessment and oversight of scientific research activities that have significant dual-use potential, which should be carried out during all phases of the research cycle.

54. In order to further efforts on education and awareness-raising about risks and benefits of life sciences and biotechnology, States Parties agreed on the value of using science responsibly as an overarching theme to enable parallel outreach efforts across interrelated scientific disciplines, as well as taking full advantage of active learning techniques, consistent with national laws and regulations.

55. States Parties agreed on the value of promoting education on the Convention and the dual-use nature of biotechnology, including through preparing easily accessible and understandable courses, integrating consideration of biosecurity with broader efforts on bioethics, and assessing the impact of such education.

56. In light of the growing convergence between the fields of biology and chemistry, States Parties agreed on the value of furthering efforts to build and sustain coordination between the Convention and the Chemical Weapons Convention, while respecting the legal and institutional bases of each convention. States Parties recognized the value of exploring appropriate ways and means to promote greater collaboration between the CWC and the Convention to analyze potential benefits, risks and threats resulting from relevant advances in science and technology.

57. States Parties agreed on the value of increasing the participation of scientific and technical experts in national delegations to Meetings of Experts. States Parties also recognized the value of contributions to the Sponsorship Programme to facilitate such participation.

58. Recognizing the importance of thoroughly and effectively reviewing science and technology developments relevant to the Convention, and of keeping pace with rapid changes in a wide range of fields, States Parties agreed on the value of considering, in future meetings, possible ways of establishing a more systematic and comprehensive means of review.

59. States Parties recognized the valuable contribution to their work of associated stakeholders in science, academia and industry and agreed on the importance of continuing to encourage them to participate, as appropriate, in the intersessional programme.

C. 2014

60. States Parties identified certain advances in science and technology that have potential benefits for the Convention and agreed on the need to share information on these developments, including on the improved understanding of, and technologies to investigate:

(a) Virulence mechanisms;

(b) Pathogenesis, which should enable more rapid responses to, and the development of countermeasures against, new or re-emerging pathogens;

(c) Host-pathogen interactions, offering new opportunities for: disease surveillance, detection, and diagnosis, including making vaccine and drug production simpler, faster, cheaper and more efficient; the identification of targets to treat or prevent disease; negating the mechanisms that pathogens use to evade or disrupt the host immune system; identifying virulence factors in emerging pathogens; and the development of more specific vaccines, therapeutics and diagnostics; and

(d) Toxins, providing new avenues for medicine and research, such as treatments for neuromuscular disorders and post exposure therapy, as well as toxin detection and diagnosis.

61. States Parties reviewed various enabling technologies, including, for example, genome editing tools including those derived from bacterial "immune systems", such as CRISPR/CAS9, as well as those related to continuing progress in synthetic biology.

62. States Parties reviewed advances derived from the convergence of scientific disciplines, including biology, chemistry and nanotechnology. States Parties noted the value of continuing to consider how these advances might be applied to defensive countermeasures, protective clothing and equipment, decontamination, medical countermeasures, as well as for detection and diagnosis.

63. States Parties noted that some of the developments reviewed have the potential for uses contrary to the provisions of the Convention, including: the creation of novel, highly-contagious, virulent pathogens; and programming cells to produce toxins, viruses or other biological materials which could cause harm. States Parties also agreed on the importance of facilitating the fullest possible exchange of relevant technologies where their use is fully consistent with the peaceful object and purpose of the Convention.

64. States Parties also noted the value of continuing to review gain-of-function work and consider the possible implications for the Convention in future meetings.

65. Research that is identified as being of dual-use concern is often vitally important to science, public health and agriculture, and its findings often contribute meaningfully to the broader base of knowledge that advances scientific and health objectives. States Parties recognised that identifying research as being of dual-use concern does not, in itself, provide sufficient justification for proscribing or restricting its availability, or for preventing its pursuit. Identifying research as being of dual-use concern does necessitate greater national oversight, and for a collaborative and informed assessment of the potential benefits and risks of the research. States Parties noted the value of addressing associated safety and security risks as well as the possible misuse of research results and products. States Parties also noted the value of continued discussion at future meetings on oversight of dual-use research of concern, including specific approaches to: identifying relevant criteria; assessing both risks and possible benefits; and mitigating identified risks.

66. States Parties noted the value of model voluntary codes of conduct. States Parties recognised that codes of conduct, whilst being the prerogative of States Parties, encourage responsible scientific conduct by helping to address risks that life science research output could be used for harm. Codes of conduct, including those developed and used by scientific organizations and institutions, help to support the responsibility of individual scientists to consider the potential consequences, both positive and negative, of their work. Relevant codes of conduct should avoid placing any undue restrictions on the exchange of scientific discoveries consistent with the objectives of the Convention and justified for protective, prophylactic or other peaceful purposes.

67. In order to further efforts on education and awareness-raising about risks and benefits of life sciences and biotechnology, States Parties noted the value of:

(a) Continuing to support, collectively and individually, the promotion of a culture of responsibility and biosecurity among life scientists; and

(b) Making full use, at the national level, of scientists engaged in education and awareness-raising efforts, to identify relevant advances and related issues, and to keep national legal and regulatory frameworks up to date.

68 States Parties noted the value of continued discussion at future meetings of the convergence between the fields of biology and chemistry, and other scientific disciplines.

69. Recognizing the importance of thoroughly and effectively reviewing science and technology developments relevant to the Convention, of keeping pace with rapid changes in a wide range of fields, and in exploring opportunities for enhanced cooperation and sharing of technology identified by such reviews, States Parties reiterated the value of continuing to consider, in future meetings, possible ways of further strengthening scientific review. In this context, the important role played by national experts in the Meeting of Experts was

emphasized as well as the value of contributions to the sponsorship programme to facilitate such participation.

D. 2015

70. States Parties identified certain advances in science and technology that have potential benefits for the Convention and agreed on the need to share information on these developments, including on the improved understanding of, and technologies to investigate:

(a) Advances of relevance to agriculture, such as improved biological control methods to combat plant pests and diseases, and approaches to improve food production;

(b) Advances and research in biology, biotechnology, bioengineering and biomedical engineering, in particular, developments in enabling technologies including high-throughput systems for sequencing, synthesizing and analyzing DNA, bioinformatics and computational tools and systems biology, host-pathogen interactions for enhanced cooperation and making vaccines, medicines and diagnostics production simpler, faster, cheaper and more efficient in developing countries; and

(c) Advances in immunology, and various enabling technologies, including, inter alia, genome editing tools including those derived from bacterial "immune systems", such as CRISPR, as well as those related to continuing progress in synthetic biology.

71. States Parties noted that some of the developments reviewed have the potential for uses contrary to the provisions of the Convention, including: the creation of novel, highly-contagious, virulent pathogens; and programming cells to produce toxins, viruses or other biological materials which could cause harm. States Parties also agreed on the importance of facilitating the fullest possible exchange of relevant technologies where their use is fully consistent with the peaceful object and purpose of the Convention.

72. To further address strengthening national biological risk management, as appropriate, in research and development involving new science and technology developments of relevance to the Convention, States Parties noted that a possible measure may include a comprehensive examination of appropriate oversight criteria, inter alia, reaching common understandings on optimal methods, including appropriate criteria, as required, for assessing risks and benefits, including risks of misuse, and optimal approaches to mitigating risks, identified at BWC meetings. States Parties further noted that measures taken to mitigate biological risk should be proportional to assessed risk and not hamper peaceful activities, including international cooperation.

73. To further address voluntary codes of conduct and other measures to encourage responsible conduct by scientists, academia and industry, States Parties noted the value of considering a template for voluntary codes of conduct for scientists in the fields relevant to the Convention, States Parties also noted the need to bring in a diverse range of expertise from all relevant fields and noted the need to avoid codes of conduct imposing restrictions and/or limitations inconsistent with the Convention.

74. To further address education and awareness-raising about risks and benefits of life sciences and biotechnology, States Parties recognized that the continuous and accelerating rate of progress in scientific knowledge requires the necessity of deepening a culture of responsible use of this knowledge, which takes into account the object and purpose of the Convention without undermining peaceful uses. In order to further efforts on education and awareness-raising about risks and benefits of life sciences and biotechnology, States Parties discussed on the need to share information and knowledge on these developments, including dual-use research of concern.

75. To further address science- and technology-related developments relevant to the activities of multilateral organizations such as the WHO, OIE, FAO, IPPC and OPCW, States

Parties noted that the increasing convergence of chemistry and biology underlines the importance of continuing to build and sustain cooperation between the Convention and the Chemical Weapons Convention to assist analysis of the potential benefits and risks resulting from advances in converging scientific and technological areas.

76. Recalling the decision of the Seventh Review Conference for the 2015 Meetings to address the topical scientific subject of any advances in production, dispersal and delivery technologies of biological agents and toxins, States Parties noted that advances in such technologies and its implications needs to be discussed further.

77. States Parties recognized the value of continuing discussions on science and technology developments relevant to the Convention in light of various proposals made by States Parties.

78. States Parties noted that among the lessons identified by assessments of the international response to the Ebola Virus Disease (EVD) outbreak in West Africa was the need to expand investment in research and development on diagnostics, drugs and vaccines, and also recognize the importance of the accessibility of science and technology developments related to the response of any outbreak.

Annex III

Working Papers presented by States Parties between 2012 and 2017

Review of science and technology developments relevant to the Convention, including for the enhanced implementation of all articles of the Convention as well as the identification of potential benefits and risks of new science and technology developments relevant to the Convention, with a particular attention to positive implications

BWC/MSP/2017/WP.2 Need to establish a BWC science and technology review process. Submitted by Switzerland

BWC/CONF.VIII/WP.12 The BTWC review process of science and technology. Submitted by the Islamic Republic of Iran

BWC/CONF.VIII/WP.17 Review of developments in science and technology: Key points from the 2012-2015 BTWC intersessional programme. Submitted by the United Kingdom of Great Britain and Northern Ireland

BWC/CONF.VIII/WP.26 Proposals for the Final Document of the Eighth Review Conference of the Biological and Toxin Weapons Convention (BTWC): Intersessional Programme, Implementation Support Unit and Science and Technology. Submitted by the Bolivarian Republic of Venezuela on behalf of the Group of the Non-Aligned Movement and Other States

BWC/CONF.VIII/PC/WP.2 and Rev.1 and 2 Proposal for the establishment of a Scientific Advisory Committee. Submitted by the Russian Federation

BWC/CONF.VIII/PC/WP.3 Science and technology review for the BWC: Features of an effective process. Submitted by the United States of America

BWC/CONF.VIII/PC/WP.4 A future science and technology review process. Submitted by the United Kingdom of Great Britain and Northern Ireland

BWC/CONF.VIII/PC/WP.7 Elements on science and technology for the 2016 Review Conference: The importance of an active review process. Submitted by Finland, Norway and Sweden

BWC/CONF.VIII/PC/WP.8 Strengthening the BWC science and technology review process. Submitted by Switzerland

BWC/CONF.VIII/PC/WP.16 Strengthening the BWC science and technology review process: Considerations regarding the composition of an S&T review body. Submitted by Switzerland

BWC/CONF.VIII/PC/WP.18 New scientific and technological developments relevant to the Convention: Some examples. Submitted by the United States of America

BWC/CONF.VIII/PC/WP.27 Reviewing science and technology within the BWC: Elements for a politically independent process. Submitted by Spain

BWC/MSP/2015/WP.10 Reviewing Developments in science and technology: Examples of dedicated processes. Submitted by Switzerland

BWC/MSP/2015/WP.14 and Corr.1 Science and technology advances and the application of "dual use". Submitted by the Islamic Republic of Iran

BWC/MSP/2015/MX/WP.5 Advances in science and technology: Production and delivery. Submitted by the United States of America

BWC/MSP/2015/MX/WP.11 Reviewing developments in science and technology: Parameters and considerations for a dedicated process. Submitted by Switzerland

BWC/MSP/2015/MX/WP.12/Rev.1 Advances in science and technology: Production, dispersal and delivery technologies. Submitted by the United Kingdom of Great Britain and Northern Ireland

BWC/MSP/2015/MX/WP.15 Review of developments in the field of science and technology and Article X of the Convention. Submitted by the Islamic Republic of Iran

BWC/MSP/2014/MX/WP.2 Advances in science and technology: Understanding pathogenicity and virulence. Submitted by the United States of America

BWC/MSP/2014/MX/WP.4 Advances in science and technology: Evasion of the host immune response by pathogens. Submitted by the United Kingdom of Great Britain and Northern Ireland

BWC/MSP/2013/WP.5 Establishing a dedicated structure for the review of developments in biological science and technology. Submitted by Switzerland

BWC/MSP/2013/MX/WP.5 Developments in science and technology - diagnostics – Submitted by the United States of America

BWC/MSP/2013/MX/WP.8 Advances in science and technology: Vaccine development – Submitted by the United Kingdom of Great Britain and Northern Ireland

BWC/MSP/2013/MX/WP.11 Advances in laboratory diagnostics, point of care detection, pathogen characterisation and potential benefits to the Biological and Toxin Weapons Convention – Submitted by South Africa

BWC/MSP/2012/MX/WP.6 Developments in science and technology - Submitted by the United States of America

BWC/MSP/2012/MX/WP.10 Review of global developments in the field of biological sciences and biotechnologies in 2011-2012 that are relevant to the BTWC and have dual-use potential - Submitted by the Russian Federation

BWC/MSP/2012/MX/WP.14 The effect/impact of biotechnology progress on BWC – Submitted by China

Biological risk assessment and management

BWC/CONF.VIII/WP.32 and Corr.1 A coordinated approach to enhancing bio-risk mitigation: National CBRN Action Plans. Submitted by Cote d'Ivoire, Gabon, Georgia, Kenya, Montenegro, Morocco, Philippines, Republic of Moldova, Serbia, Senegal and Uganda

BWC/CONF.VIII/PC/WP.25 Frameworks for effective oversight of scientific research facilities and awareness of dual-use risks. Submitted by Canada

BWC/MSP/2015/WP.2 Biosafety and biosecurity: today's challenges for politics and science. Report from a seminar held on 25 June 2015 in Vienna. Submitted by Austria

BWC/MSP/2015/MX/WP.4 The United States of America high containment laboratory policy. Submitted by the United States of America

BWC/MSP/2015/MX/WP.17 Consideraciones y medidas para mejorar la biocustodia de los materiales y agentes biológicos y de las instalaciones biológicas. Presentado por Chile, Ecuador, El Salvador, España, Italia y Panamá

BWC/MSP/2015/MX/WP.19 National Measures to Address Dual Use Research. Submitted by Indonesia, Malaysia, Netherlands and the United States of America

BWC/MSP/2014/MX/WP.7 and Corr.1 The United States of America government policy for oversight of life sciences dual use research of concern (DURC). Submitted by the United States of America

BWC/MSP/2014/MX/WP.6 Aplicación nacional de la Convención sobre las Armas Biológicas: Una herramienta para la evaluación de las instalaciones con agentes biológicos. Presentado por Chile, Colombia, España y México

BWC/MSP/2013/MX/WP.4 Key biosecurity-related changes made to the USA select agent regulations – Submitted by the United States of America

BWC/MSP/2012/WP.3 The United States Government's Biotransparency and Openness Initiative. Submitted by the United States of America

BWC/MSP/2012/MX/WP.12 Measures for mitigation of risks due to new science and technology developments of relevance to the BWC - Submitted by the European Union

BWC/MSP/2012/MX/WP.15 Update on Australia's Security Sensitive Biological Agents (SSBA) Regulatory Scheme - Submitted by Australia

Development of a voluntary model code of conduct for biological scientists and all relevant personnel, and biosecurity education, by drawing on the work already done on this issue in the context of the Convention, adaptable to national requirements

BWC/MSP/2017/WP.22 Awareness-raising, education and outreach: recent developments. Submitted by Ukraine, Japan and the United Kingdom of Great Britain and Northern Ireland

BWC/CONF.VIII/WP.2 Código sobre la ética profesional de los trabajadores de la ciencia en Cuba. Presentado por Cuba

BWC/CONF.VIII/WP.10 Awareness raising, education and outreach: An example of best practice. Submitted by Ukraine and the United Kingdom of Great Britain and Northern Ireland

BWC/CONF.VIII/WP.30* Proposal for the development of a model code of conduct for biological scientists under the Biological Weapons Convention. Submitted by China and Pakistan

BWC/CONF.VIII/PC/WP.31 Proposal for the development of the template of biological scientist code of conduct under the framework of Biological Weapons Convention. Submitted by China and Pakistan

BWC/MSP/2015/WP.9 Proposal for the development of the template of biological scientist code of conduct under the Biological Weapons Convention. Submitted by China

BWC/MSP/2014/WP.6 "Código de Conducta para Científicos". Presentado por Chile, Colombia, Costa Rica, Ecuador, El Salvador, España, Guatemala, Italia y México

BWC/MSP/2012/WP.2 The crucial role of life scientists in the effective implementation of the BTWC. Submitted by Poland

BWC/MSP/2012/WP.4 Considerations and recommendations to inculcate awareness of the dual-use challenge into biosafety and biosecurity training and education for life scientists in States Parties. Submitted by Canada

BWC/MSP/2012/WP.9 "Código de Conducta para Científicos". Presentado por Chile, Colombia, España, Italia y México

Genome editing, taking into consideration, as appropriate, the issues identified above

Any other science and technology developments of relevance to the Convention and also to the activities of relevant multilateral organizations such as the WHO, OIE, FAO, IPPC and OPCW

BWC/CONF.VIII/WP.20 and Corr.1 Technological developments for the decoding of new, old and ancient infectious disease outbreaks and incidents lessons for the BTWC. Submitted by Sweden

BWC/MSP/2015/MX/WP.6 Tacit knowledge: The concept and its implications for biological weapons proliferation. Submitted by the United States of America

BWC/MSP/2015/MX/WP.8 and Corr.1 Convergence between biology and chemistry: Latest findings of relevance to the Biological and Toxin Weapons Convention. Submitted by Switzerland

BWC/MSP/2015/MX/WP.9 Advances in science and technology: impact on response to infectious disease outbreaks and relevance to Article VII. Submitted by the United Kingdom of Great Britain and Northern Ireland

BWC/MSP/2012/MX/WP.1 The convergence of chemistry and biology: implications of developments in neurosciences - Submitted by the United Kingdom of Great Britain and Northern Ireland

BWC/MSP/2012/MX/WP.16 The convergence of chemistry and biology: Implications for the review of developments in the field of science related to the Convention - Submitted by Australia